Spaceborne Sensors Observe El Niño Teleconnection in the Northeast Pacific

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Three regions of anomalous warming in the North Pacific Ocean observed in 1997 are found to be related to wind anomalies through different mechanisms. The anomalous warming along the equator is part of the El Niño condition and is related to the westerly wind anomalies and the relaxation of the trade-winds over the equatorial Pacific. The equatorial westerly wind anomalies are connected to the anomalous cyclonic wind pattern in the northeast Pacific. The anomalous warming along the west coast of the United States is the result of the movement of the pre-existing warm sea surface temperature (SST) anomalies with the cyclonic wind anomalies toward the coast. The warm SST anomalies are part of an anomalous SST dipole which has been present for more than a year in the Northeast Pacific. The dipole of SST anomalies is found to be largely driven by anomalous surface heat flux. Winds coming from the tropical ocean bring heat and moisture; they suppress evaporative cooling. The associated clouds may also block solar heating. The opposite is true for winds from the north. Relatively weaker SST anomalies are also observed off the coast of Mexico. Under normal conditions, the subtropical high-pressure system off the Mexican coast, with northerly winds along the shore, will cause off-shore Ekman transport and coastal upwelling of cold water. In 1997, the subtropical high was displaced by a low-pressure system and the associated southerly winds; coastal upwelling was suppressed and warm anomalies appeared. Spacebased data and simulations from numerical models are used to understand the maintenance of the decadal anomalies in the northeast Pacific and their modification by the interannual El Nino events.